Advanced Data Analysis Tool

(ADAT)

Thor Design Panel 3

84K01900-020

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DRAFT VERSION 2

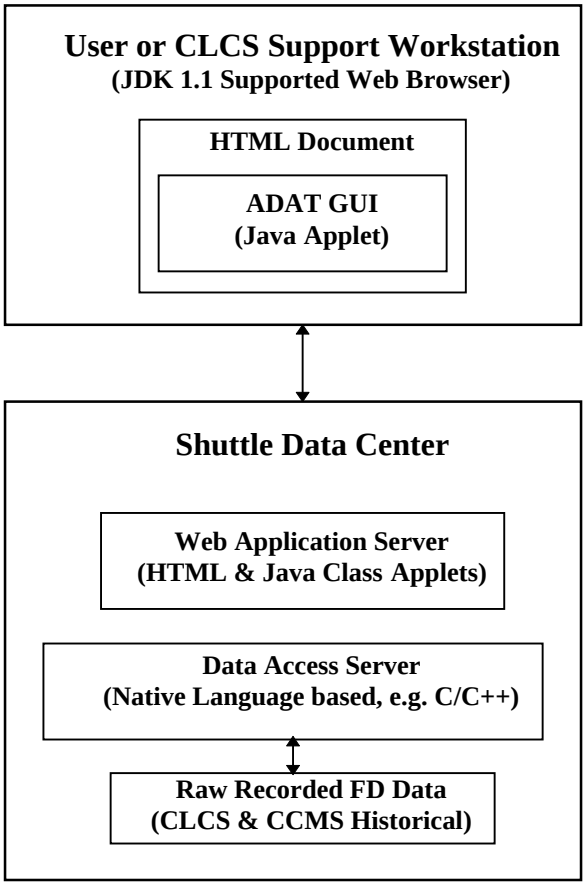
1. Advanced Data Analysis Tool

1.1 Advanced Data Analysis Tool Introduction

1.1.1 Advanced Data Analysis Tool Overview

The Advanced Data Analysis Tool (ADAT) will provide a platform independent Web based Data Analysis capability for plotting and analyzing data. The ADAT Graphical User Interface (GUI) will be available on the Checkout and Launch Control System (CLCS) Support Workstation or a NASA center office workstation running a Web browser (e.g., Netscape's Navigator, Microsoft's Internet Explorer). The first release of the ADAT software will be new for Thor.

The ADAT Java language based applet(s) will provide users access to data retrieved via a Data Server on the Shuttle Data Center (SDC). The ADAT applet classes will reside on a SDC Web server and will be executed from a browser HTML instruction on the CLCS Support Workstation in the OCR or from an office workstation.



1.1.2 Advanced Data Analysis Tool Operational Description

The ADAT GUI will provide users the capability of viewing historical data in a table or graphic format. Parameters required include TCID, start and stop time/date, data source, and function designators. Some options will be available for configuring layout and display. A basic statistics capability will be available supporting Min/Max, Mean, and Standard Deviation. Users will be allowed to print output to any network connected printer. Hypertext help and documentation will be made available online.

1.2 Advanced Data Analysis Tool Specifications

1.2.1 Advanced Data Analysis Tool Groundrules

- The ADAT is NOT available on the Command and Control Workstation.
- The ADAT print capability will be dependent on available and supported network printers.
- CLCS data retrievals will be dependent on the CLCS Record and Retrieval Phase I Thread capability.

1.2.2 Advanced Data Analysis Tool Functional Requirements

The Functional Requirements for the Advanced Data Analysis Tool are arranged in the following major/minor functions:

1. Supported Tool Sets
2. Supported Environments
3. Supported Data Interfaces
4. Main Data Request Graphical User Interface (GUI)
5. Graph/Plotting Display Views
6. Table Display View
7. Analog Statistics
8. Help Displays

1 Supported Tool Sets

1.1 The ADAT shall be developed using the Java Development Kit (JDK) version 1.1 or higher.
1.2 The ADAT shall be executed using a JDK 1.1 supported web browser (e.g., HotJava Browser or new versions of Netscape Navigator and Microsoft's Internet Explorer).

2 Supported Environments

1.1 The ADAT shall execute on the CLCS Support Workstation.
1.2 The ADAT shall execute on the Office Workstation.

3 Supported Data Interfaces

1.1 The ADAT shall use SDC CLCS historical data.
1.2 The ADAT shall use SDC CCMS historical data.

4 Main Data Request Graphical User Interface (GUI)

1.1 The ADAT shall allow the selection of the TCID.
1.2 The ADAT shall allow the selection of the data source (i.e., CCMS or CLCS) or provide for auto-selection of the data source.
1.3 The ADAT shall allow the selection of Start / Stop time and Dates.
1.4 The ADAT shall allow the selection of up to 6 valid Function Designators (FDs) available in the data stream.
1.5 The ADAT shall provide a message or indicator to inform the user of downloading and analysis status.
1.6 The ADAT shall provide to the user the ability to select graphical or tabular results.
1.7 The ADAT shall provide to the user the ability to execute the retrieval request.
1.8 The ADAT shall provide to the user the ability to Exit the program.

5 Graph/Plotting Display Views

1.1 The ADAT shall provide the capability for multiple FD plots.
1.2 The ADAT shall provide a zooming capability.
1.3 The ADAT shall provide the capability for line (square wave) plots.
1.4 The ADAT shall provide the capability for scatter plots.
1.5 The ADAT shall provide the capability for auto-scaling of data results.
1.6 The ADAT shall provide the capability for user scaling of data results.
1.7 The ADAT shall provide the capability for graphic printing to a network printer.
1.8 The ADAT graph/plot screen display shall indicate the time and date of the retrieval.
1.9 The ADAT graph/plot screen display shall indicate the TCID of the retrieval.
1.10 The ADAT graph/plot screen display shall indicate the FD(s) of the retrieval.

6 Table Display Views

1.1 The ADAT shall provide the capability for tabular views of individual or multiple FD data.
1.2 The ADAT shall provide a “list change” formated table.
1.3 The ADAT shall provide an “all sample data” formated table.
1.4 The ADAT shall provide the capability for window scrolling to display large tables.
1.5 The ADAT shall provide the capability for table view printing to a network printer.
1.6 The ADAT table screen display shall indicate the time and date of the retrieval.
1.7 The ADAT table screen display shall indicate the TCID of the retrieval.
1.8 The ADAT table screen display shall indicate the FD(s) of the retrieval.

7 Analog Statistics

1.1 The ADAT shall provide a Minimum Value statistic of the retrieved data sample(s) timeframe.
1.2 The ADAT shall provide a Maximum Value statistic of the retrieved data sample(s) timeframe.
1.3 The ADAT shall provide a Mean (Average) Value statistic of the retrieved data sample(s) timeframe.
1.4 The ADAT shall provide Standard Deviation and/or Variance statistics of the retrieved data sample(s) timeframe.

8 Help Display Views

1.1 The ADAT shall provide On-Line Help on all main displays.
1.2 The ADAT may use a combination of Popup displays and/or HTML documents to display help information to the user.
1.3 The ADAT user documentation will be provided in hypertext (e.g., HTML) format.

1.2.2.1 Future ADAT Requirements and Ideas

Future Requirements for the Advanced Data Analysis Tool may include some of the following:

1. User labeling of graphic plots
2. The capability to save a data retrieval sample to the user's local workstation.
3. The capability to use a saved data sample with external data analysis/statistics software
4. Support for other table format views
5. Support for other graphic plot format views
6. Real-time plotting
7. Providing FD selection from a scrollable list that reacts to keystrokes.
8. Providing a pull down list of TCIDs.
9. Providing access to DSTAT (e.g., available times and dates for TCID)
10. Utilization of user configuration and/or preference files
11. The capability to have a table and graph view up simultaneously
12. The ADAT shall be available from other NASA Centers.

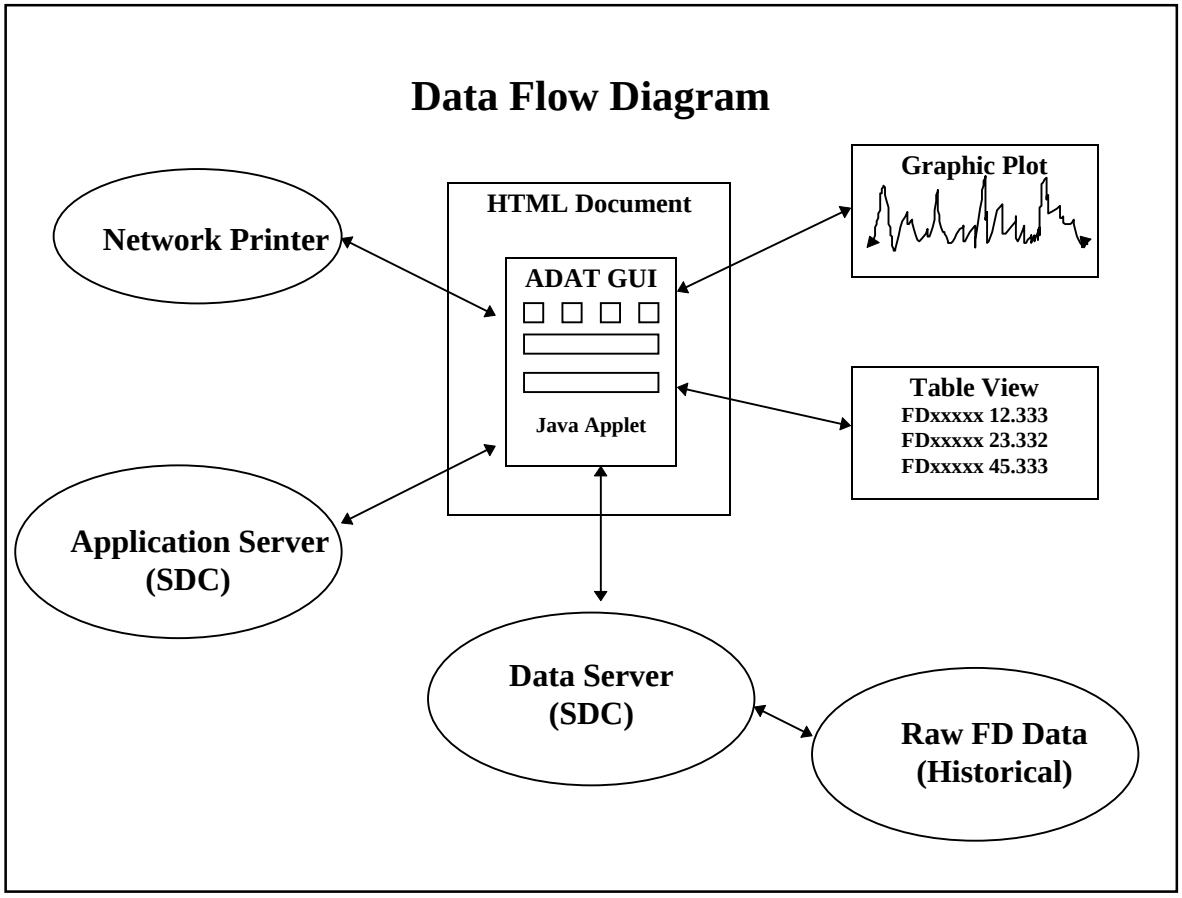
1.2.3 Advanced Data Analysis Tool Performance Requirements

1 End to End Performance

1.1 For a 1 sample / second single FD and for a 6 minute time frame, ADAT shall begin displaying data to the screen within 1 second after data has been downloaded to user workstation.

1.2.4 Advanced Data Analysis Tool Flow Diagram

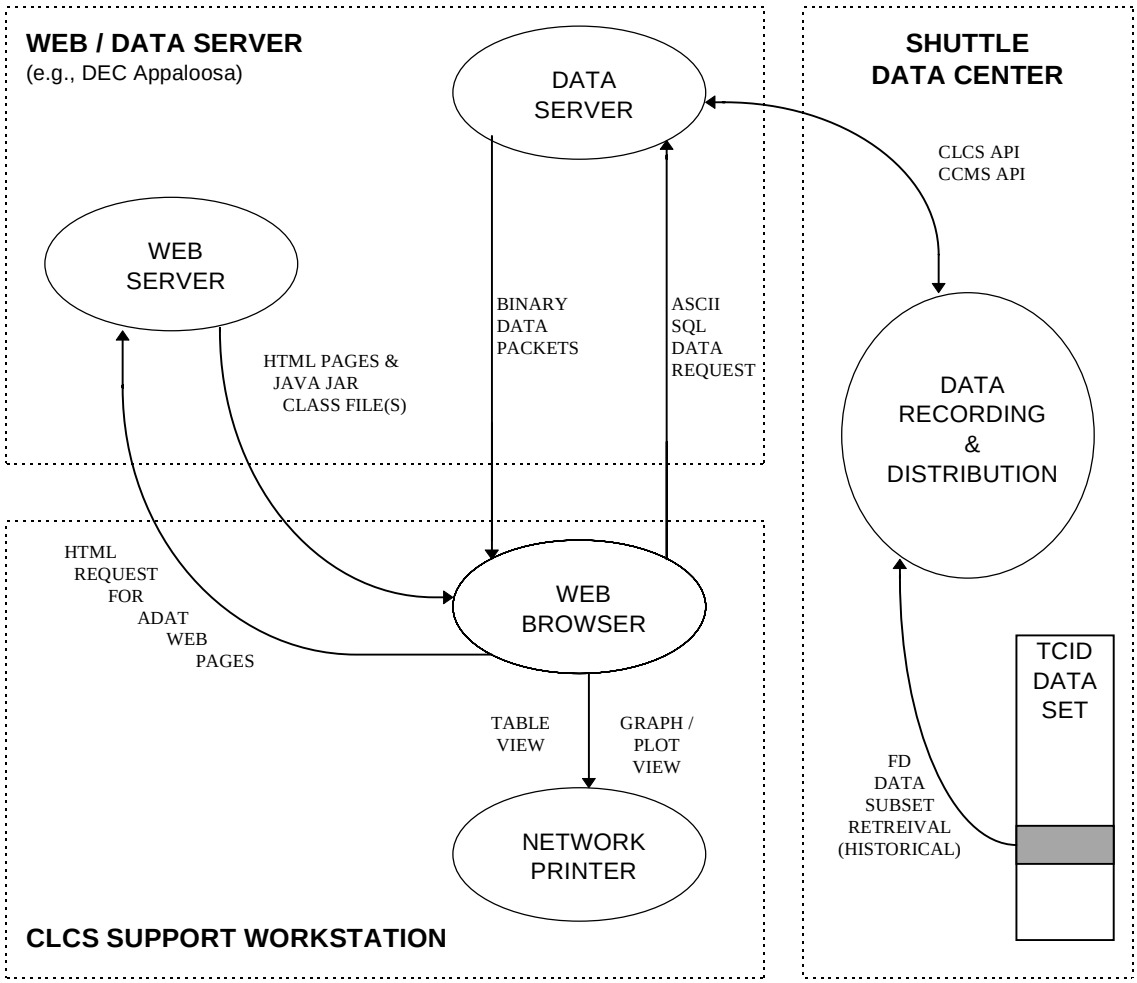
When executed via a Web browser the ADAT is downloaded from the SDC application server to the browser. The browser then executes the ADAT byte code and displays it on the Web page. The user interfaces with the ADAT GUI by selecting options and requesting data. The user's request is sent to the ADAT Data Server and results are returned to the Web browser.



1.3 Advanced Data Analysis Tool Design Specifications

The ADAT Graphical User Interface (GUI) will accept the TCID, start and stop parameters for date and time, and up to 6 function designators. Text boxes and/or pull-down combo-boxes will be used for TCID, date, time and function designator fields. If required, radio buttons will be used for the data source. A "Submit" button will be provided as the final step for the user to perform the data retrieval request.

1.3.1 Advanced Data Analysis Tool Detailed Data Flow



1.3.2 Advanced Data Analysis Tool (ADAT) External Interfaces

The ADAT has two primary external interfaces which may or may not be on the same physical hardware platform:

1. **ADAT Web Server -** This server accepts HTML commands and returns HTML documents (ASCII) and/or the ADAT Java applet class files (binary) to the client.

   - ADAT HTML Document Request Format Example:
     http://CLCSdev.ksc.nasa.gov/Adat/Adat_ProtoType.html

   - ADAT JAVA Applet HTML Code Example:
     <applet code="Adat.class" codebase="../class/CLCS/Adat" align="baseline" width="164" height="56">Sorry, you can't run this Java 1.1 Applet</applet>

2. **SQL Data Server -** This server accepts commands from the client side ADAT Java applet and forwards them as a SQL data request (ASCII) to the Shuttle Data Center (SDC) for processing.

   - SQL Data Request Example:
     "Select FD where TCID = SA086A1 from table name ... "

1.3.2.1 ADAT Message Formats

The following are the minimum set of messages that will be included in this release of the ADAT. These messages may be handled by way of an exception or a logical process.

1.3.2.1.1 Informational Messages

- **Successful Network Connection** - ADAT was able to connect to the Data Server
- **Successful Data Retrieval** - The Data Server was able to successfully download a data subset
- **Data request query in progress** - ADAT is currently processing a data retrieval request
- **Data Server Messages** - ADAT will display all messages from the Data Server

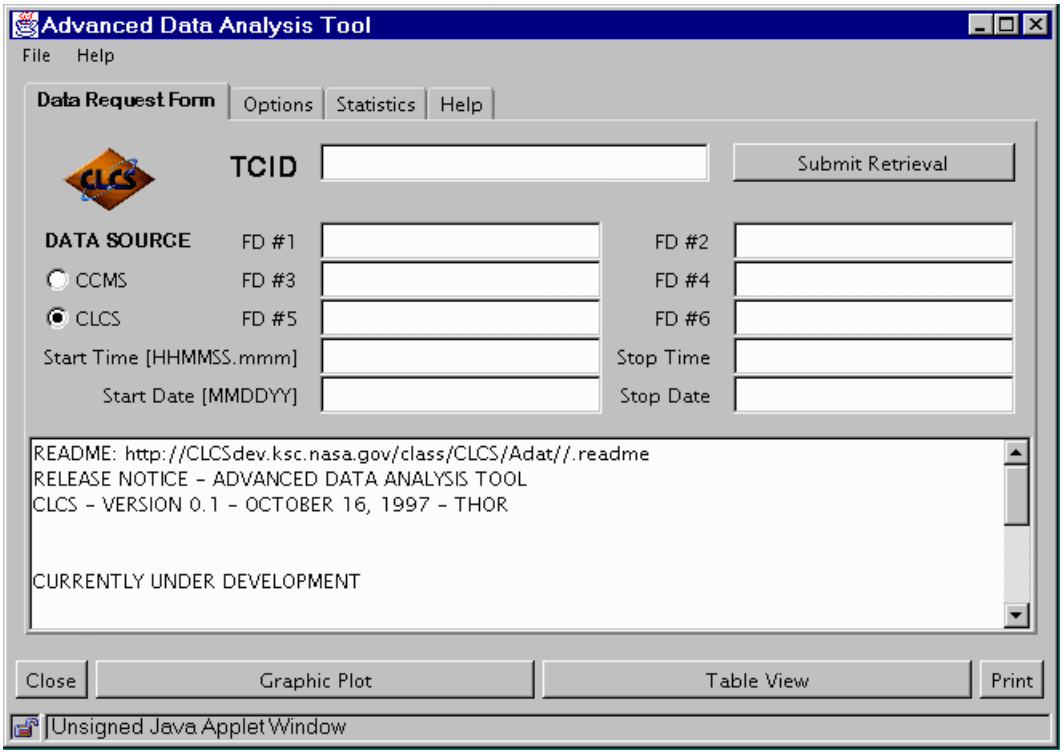
1.3.2.1.2 Warning Messages

- **Java Warning Exceptions** - Automatically created by Java
- **Data Server Messages** - ADAT will display all messages from the Data Server

1.3.2.1.3 Error Messages

- **Unable to Connect** - ADAT was unable to connect to the Data Server
- **Unable to Complete Data Query Request** - ADAT was unable to complete a user request
- **Java Error Exceptions** - Automatically created by Java
- **Data Server Messages** - ADAT will display all messages from the Data Server

1.3.2.2 ADAT Display Formats



Data Retrieval Request Form Example (Based on an early ADAT prototype):

1.3.2.3 ADAT Input Formats

On the main ADAT data request form users input parameters in text boxes and select options via radio buttons and/or pull-down comboboxes. Key parameter formats include:

1.3.2.3.1 TCID Format - No typechecking performed (e.g., SA0A6A1), however, a TCID must be specified.

1.3.2.3.2 Function Designator (FD) Format - No typechecking performed (e.g., V41P1150C1), however, at least one FD must be specified.

1.3.2.3.3 Start and Stop Time - HHMMSS.mmm (e.g., 083423.004) and both start and stop times must be specified.

1.3.2.3.4 Start and Stop Date - MMDDYY (e.g., 110597) and both start and stop dates must be specified.

1.3.2.4 ADAT Recorded Data

There is no requirement to support the recording of data and/or data request samples in this version of the ADAT.

1.3.2.5 ADAT Printer Formats

Users will have the capability to print to a local or network connected printer. Java 1.1 supports printing and a Java class will be created to support both table and graph plot formats. The Java language calls the print dialog box that is applicable for the machine the software is running on. (i.e., A Windows NT print call dialog box will look different from a UNIX print call dialog box.) Print routines will be available for the following:

- **Graphic plots** - Prints the actual screen view in a graphics format
- **Table plots** - Prints the actual screen view in text format
- **Messages** - Print messages and message area information in text format

1.3.2.6 ADAT Interprocess Communications (C - C Communications)

The ADAT does not have Interprocess C-C Communications.

1.3.2.7 ADAT External Interface Calls

The ADAT client software (Java applet) interfaces with Data Server software. The Application Program Interface (API) is defined by the following set of documents. These documents can be found on the Shuttle Data Center web site at http://lpsweb/SDC/Docs/DAP/:

- Client API Library Reference Guide
- DAP 30%/60% Design Specifications Document
- General Library Reference Guide
- Intrinsic Library Reference Guide

Refer to Appendix D for a discussion of Data Server issues.

1.3.2.7.1 The Data Server request will be in a SQL format.

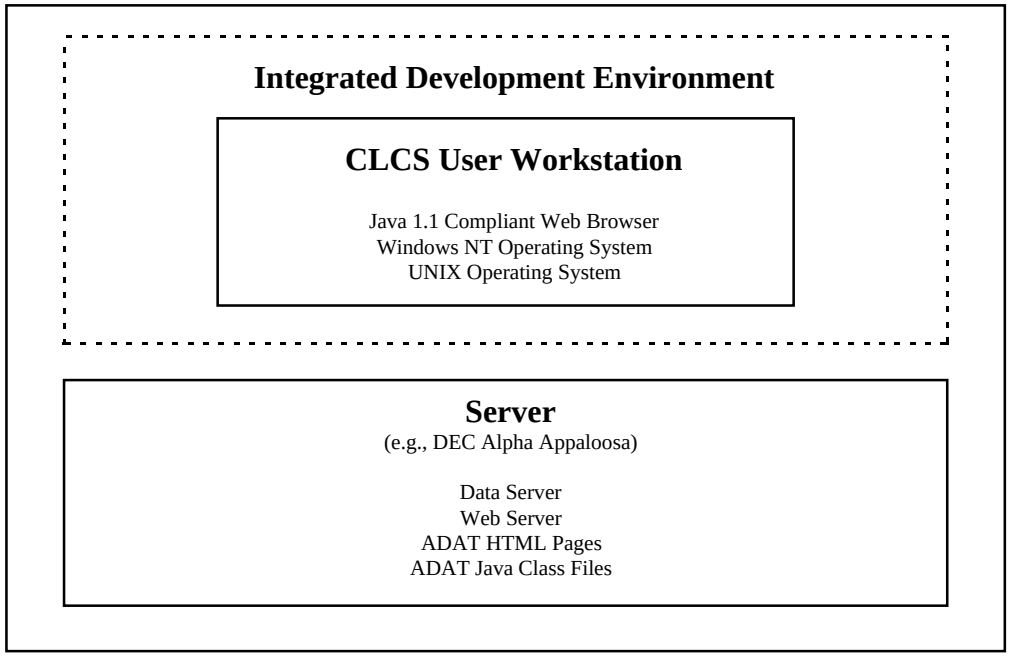
1.3.2.7.2 The Data Server sample subset, which is transfered to the client, shall be in Binary format.

1.3.2.8 ADAT Table Formats

None

1.3.3 ADAT Test Plan

A detailed test procedure will be developed that will address the particular ADAT requirements of the Thor delivery. A summary of the test requirements is presented here.



1.3.3.1 Test Environment

While ADAT is designed to run on a wide variety of computer platforms with Java-enabled COTS browsers (JDK 1.1 compliant), integrated testing will occur from a CLCS User Support Workstation that provides network connectivity to the ADAT Web and Data Server:

1.3.3.1.2 The following hardware is needed for the ADAT Test Plan:

- A CLCS User Support workstation in the Integrated Development Environment.
- A DEC Alpha server in the LCC named Appaloosa.
- A network available laser printer.

1.3.3.1.3 The following software configuration will be needed on the CLCS support workstation:

- Install a Java 1.1 compliant Web browser (e.g., Netscape Comm. 4.0 with Java 1.1 patch).

1.3.3.1.4 The following software configuration will be required on the Web/Data Server

- SQL Data Server
- Web Server
- ADAT HTML Documents
- ADAT Java Class Files

1.3.3.1.5 The following personnel are needed to perform the test:

- Quality
- NASA ADAT lead
- Contractor ADAT lead

1.3.3.1.6 Test Plan Objectives

- Verify that ADAT starts and is displayed to the CLCS User Support Workstation
- Verify that ADAT connects to the correct data source (historical)
- Verify that ADAT downloads the requested data sample/subset
- Verify that all of the ADAT screens and displays work correctly
- Verify that the ADAT generates all the correct informational, warning, and error messages

1.3.3.2 Test Tools

No additional test tools are required.

1.3.3.3 Test Cases

1.3.3.3.1 Basic Web Server Connectivity: Verify that the user can connect to the ADAT Web server and display the main ADAT HTML page using a Java 1.1 compliant Web browser.

1.3.3.3.2 ADAT Java Applet Software Load: Verify that the user can load the ADAT software from a Java 1.1 compliant Web browser.

1.3.3.3.3 ADAT Table View: Verify that a data retrieval was successful and the user can display the data in a table format.

1.3.3.3.4 ADAT Table Print: Verify that the user can print a table view.

1.3.3.3.5 ADAT Graph Plot View: Verify that a data retrieval was successful and the user can display the data in a graphical plot format.

1.3.3.3.6 ADAT Graph Plot Print: Verify that the user can print a graph plot.

1.3.3.3.7 ADAT Help & Documentation Screens: Verify that the user can view the help and documentation screens.

Appendix A

Data Analysis and Presentation Data Sources (Support for Thor)

	CDS CCMS Historical	SDC CCMS Historical	SDC CLCS Historical	SDS CCMS Real-time	SDS' CCMS et al Real-time	SCAN Server CCMS Real-time	SDS CLCS Real-time
RCWI	✓	✓	* FD only				
ADAT		✓	✓				
RDP		* FD only	✓				
PAT		✓	*	✓	*		*
JView		✓	*	✓	✓	✓	*
ANNT		✓	*	✓	*		*

RCWI - Robust CAP Web Interface
ADAT - Advanced Data Analysis Tool
RDP - Retrieved Data Presentation
PAT - Propulsion Advisory Tool
JView - JView (Java Version of PCGOAL)
ANNT - APU Neural Net Tool

* indicates potential future supported data source.

Appendix B

Development Resources

- **Java JDK Baseline**

  The Java Development Kit baseline will be Version JDK 1.1.4 which is available from http://www.javasoft.com/products/jdk/1.1/installation-win32-x86.html .

- **Symantec *Visual Cafe'***

  Visual Cafe' Professional and/or ***Visual Cafe' Database Development*** Version 2.0 is the baseline for the Java environment to be used for ADAT development. Information on this product can be found at http://www.symantec.com and http://CLCSdev.ksc.nasa.gov/cafe.html .

- **Browser Upgrade**

  This application requires a Java 1.1 supported browser. At the present time the following products support this version of Java:

  1. Netscape's Communicator with the latest Java Patch Release - http://developer.netscape.com/software/jdk/download.html
  2. Sun's Hot Java Browser- http://java.sun.com
  3. Microsoft's Internet Explorer - Not currently fully compatible

- **ADAT Test Server(s)**

  1. Early testing of ADAT code and information on the ADAT tool can be found at http://CLCSdev.ksc.nasa.gov .
  2. Future testing of the ADAT code will be performed on a Little Endian server.

Appendix C

Java Source Code Documentation Header Format

To support documentation of the ADAT source code each Java source code file will have a "JavaDoc" formated header as described by the example below:

```
/***********************************
 * Adat.java - ADAT Class File      *
 ***********************************/

package GOV.nasa.ksc.CLCS.adat;           // Java package name

import java.xxxx;                         // Import statements

/**
<B>Advanced Data Analysis Tool</B><BR>
<BR>
Full documentation can be found at <A
HREF="http://xxxx.ksc.nasa.gov">http://xxxx.ksc.nasa.gov<A>.

@author <A HREF=MAILTO:"Somebody.Weknow@ksc.nasa.gov">Somebody.Weknow</A>
NASA DP

@version 1.0 March 1, 1998

<BR>Copyright 1997 National Aeronautics and Space Administration
<BR>All Rights Reserved

<BR><BR><IMG SRC="images/ADAT.gif">ADAT Image</A>
*/

public class Adat.java extends xxxx {

...
```

Appendix D

Data Server Issues

- **CLCS versus CCMS Data Retrievals:** The currently existing Data Server can support the Advanced Data Analysis Tool for CCMS data retrievals. To support CLCS data retrievals some modification of Data Server code may be required.

- **Endian concerns:** The current data server (i.e., DEC) is a Little Endian machine. Data transfer to the client will be Binary Little Endian. If the client is a Windows NT or Windows 95 platform no conversion is required because PC's are Little Endian in nature. Most UNIX clients (i.e., SGI, Sun, HP) will require a conversion to Big Endian. Some of the Endian options that were considered in the design included:

    1. Send data as ASCII - Simple to perform but big overhead in terms of performance.
    2. *Convert data at Client - If Client is Big, conversion is required (e.g., SGI, Sun, HP).*
    3. Java to Java (Big Endian) - Easy to program but hard to perform and Java is currently slower.
    4. Convert at Server as needed - Requires modification of Data Server application.

    Option 2 has been preliminarily selected as a compromise between performance and difficulty. Also, option 2 does not require modification of existing Data Server code.